Particle tracking methodology for Lagrangian numerical simulations

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Research group:

L1P6

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Advanced modeling in Marine Energy Research Group

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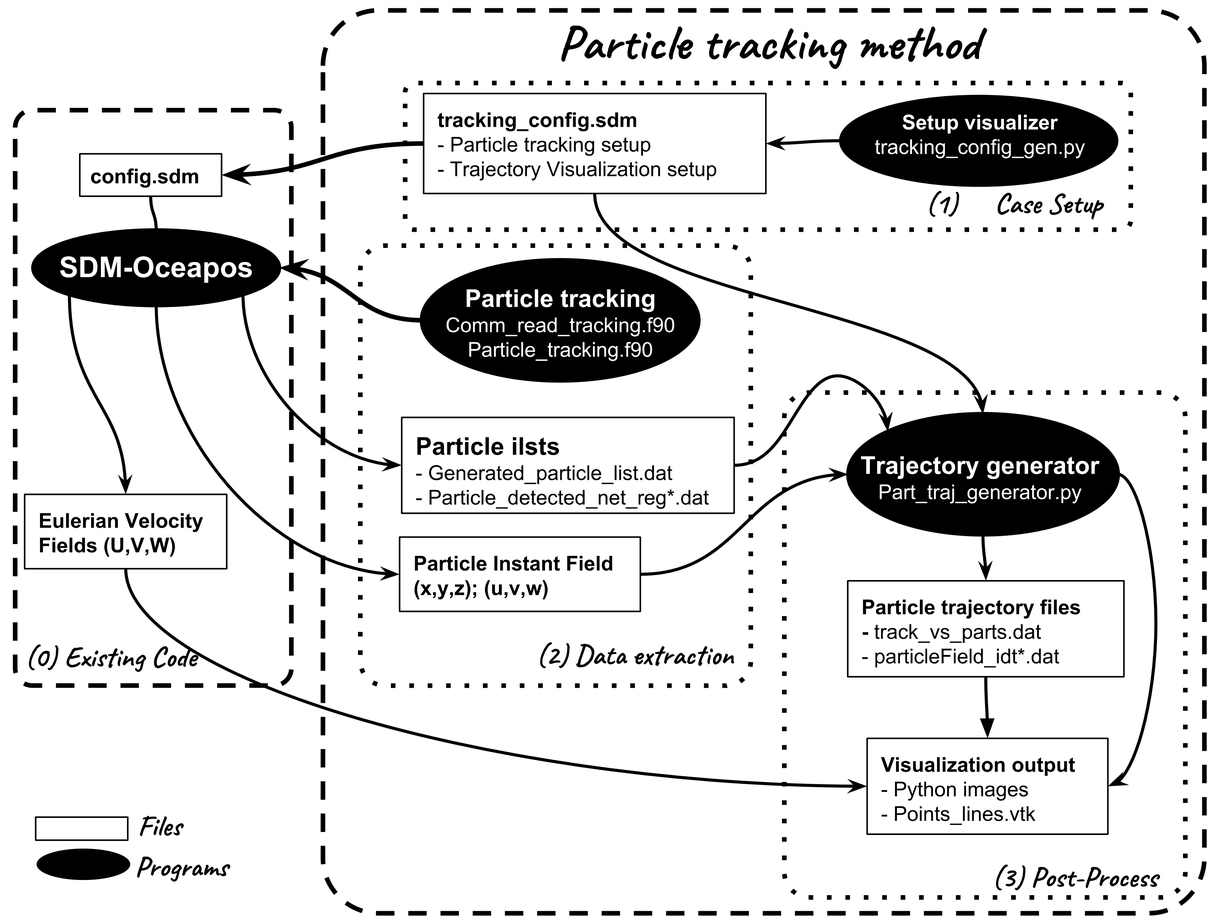
Objectives

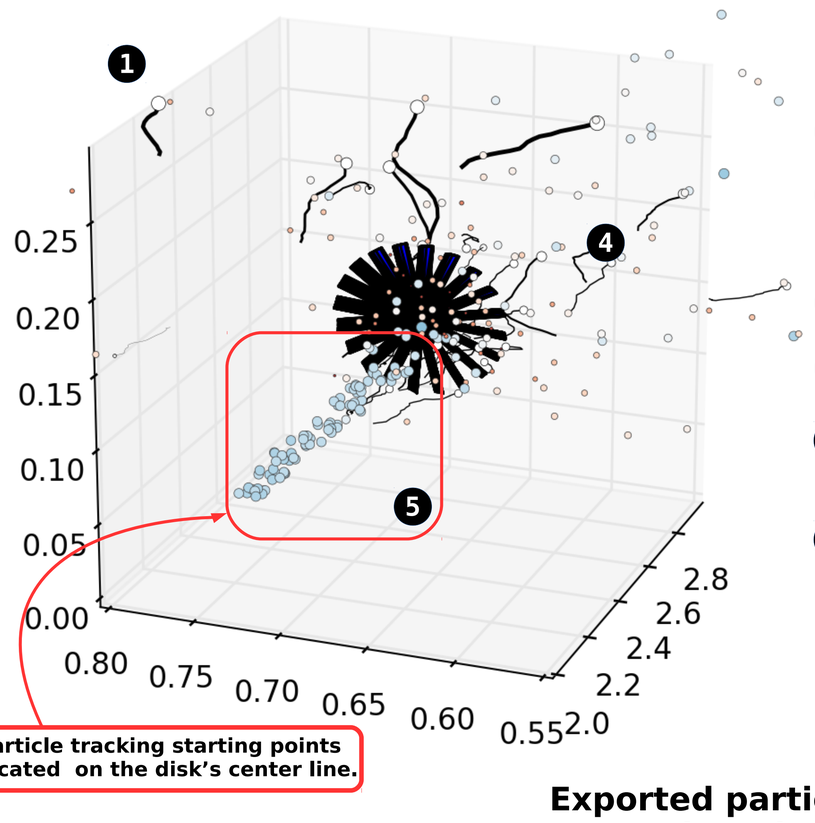
- **Reproduce the fluid particle trajectories** in order to describe the physical processes involved in the flow.
- Provide a **trajectory visualization tool** useful for SDM-OceaPos developers and users.
- Create a **plug-in version** that can be implemented independently from the existing code.
- **Automate** the methodology **customizable** to different study cases.

Numerical tool diagram



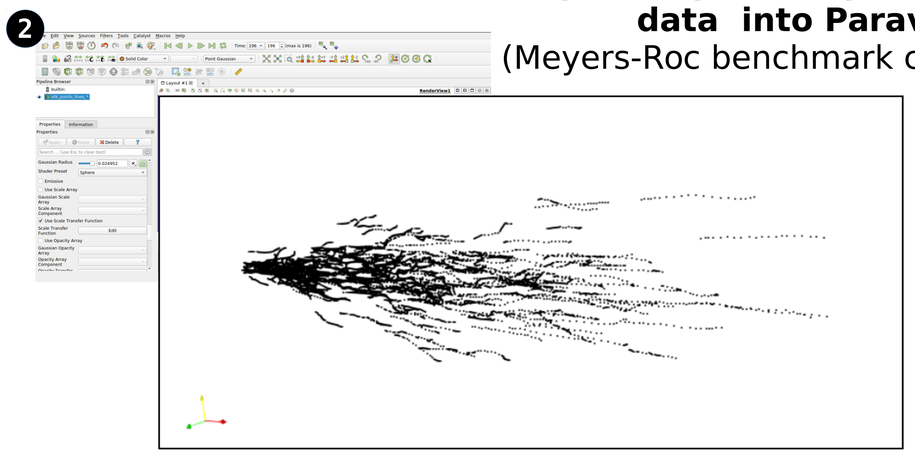
Output Features

3D visualization of a Porous-disk simulation
(Meyers-Roc benchmark case)



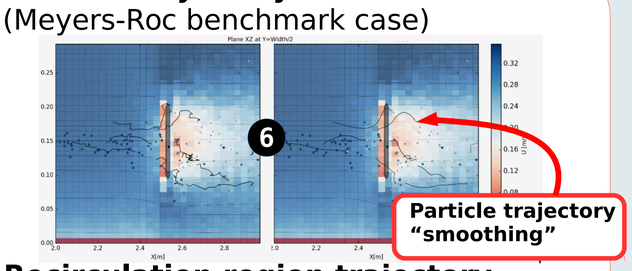
Particle tracking starting points located on the disk's center line.

Exported particle position data into Paraview
(Meyers-Roc benchmark case)

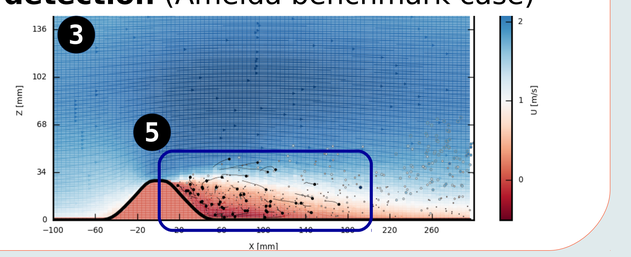


1. **3D image and animation** automated generation;
2. **Exportable .vtk files** for other visualization software (Paraview, Blender, etc.);
3. Eulerian **velocity distribution** with streamlines;
4. **Particle field** colored with instant velocity;
5. Select particle tracking **starting points**, seed-cells and particle **trajectory detection region**, "net-region";
6. Particle **trajectory visualization and post-treatment** (fluctuation reduction, resolution, etc.)

Particle trajectory treatment
(Meyers-Roc benchmark case)



Recirculation region trajectory detection (Ameida benchmark case)



Conclusions

- It was possible to extract and reproduce particle trajectories from the SDM-Ocepos simulation results.
- The tool allows the interpretation of the particle's behavior and helps to understand how it is affected by the Lagrangian algorithm.
- Intuitive parameters, such as trajectory length and particle velocity at the region of interest, can be implemented to customize the image generation.

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